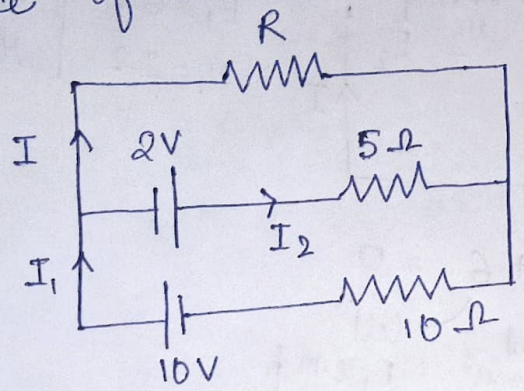
NCERT EXAMPLAR PROBLEMS

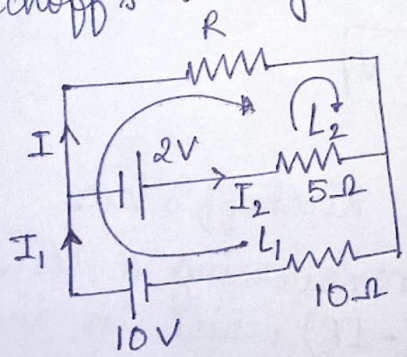
(28.) 2 cells of voltage 10V and 2V, and internal resistance 10Ω and 5Ω respectively are connected in parallel with the positive end of 10V battery connected to negative pole of 2V battery. Find the effective voltage and effective resistance of the combination.



Answer: Applying Kirchoff's junction rule,

$$I_1 = I + I_2 \quad \text{—①}$$

Applying Kirchoff's voltage law in outer loop (L_1),



$$10 - IR - 10I_1 = 0$$

$$\Rightarrow IR + 10I_1 = 10 \quad \text{—②}$$

Applying Kirchoff's voltage law in loop L_2, we get,

$$-2 - IR + 5I_2 = 0$$

$$\Rightarrow 5I_2 - IR = 2 \quad \text{—③}$$

Using eq.① & eq.③,

$$5(I_1 - I) - IR = 2$$

$$\Rightarrow 5I_1 - 5I - IR = 2 \quad \text{—④}$$

Solving eq ② and eqn ④,

(subtracting 2×(eqn. ④) − (eqn. ②))

$$3IR + 10I = 6$$

$$\Rightarrow I(R + 10/3) = 2$$

Comparing with $V = I(R + R_{eff})$, we have

Effective internal resistance = $10/3\ \Omega$

Effective voltage of the cells = 2V